RADIOCHEMICAL DETERMINATIONS FOR TAILINGS REFERENCE MATERIALS

FINAL REPORT

BY

SASKATCHEWAN RESEARCH COUNCIL

Work on this project was conducted under the auspices of the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources, Canada.

DSS FILE NUMBER : 15SQ.23440-2-9145-1
DSS CONTRACT SERIAL NUMBER : OSQ82-00182
CANMET SCIENTIFIC AUTHORITY: Dr. C.W. Smith

March 29, 1983

6 pp

MICROMEDIA
AUG 19 1983

SASKATCHEWAN RESEARCH COUNCIL

30 CAMPUS DRIVE · SASKATOON · SASKATCHEWAN · CANADA · S7N 0X1 · Tel 306 664-5400 · TELEX 074-2484

Science Serving Saskatchewan

March 29, 1983

Dr. C.W. Smith
Energy Mines and Resources Canada
Canada Centre for Mineral Technology
555 Booth Street
Ottawa, Ontario
K1A OG1

Dear Clint:

Following are the results for the radiochemical determinations on the tailings samples. I have also included some gamma spectroscopy and N.A.A. results for your information.

Radium-226 by gross alpha counting.

Sample	Results - Bq/g	Ave. Total Counts	Mean and Std. Deviation (1σ)
UTS-1	3.53, 3.53, 3.47, 3.48, 3.49	(18,000)	3.50 ± 0.03
UTS-2	5.80, 5.80, 5.89, 5.65	(30,000)	5.79 ± 0.09
UTS-3	12.9, 12.5, 12.84, 12.86	(66,000)	12.8 ± 0.2
UTS-4	39.2, 31.2, 38.0, 31.4, 37.1, 37.0, 32.1	(183,000)	35.2 ± 3.4
UTS-5	15.3, 16.3, 16.7, 16.6, 15.1, 15.0	(81,000)	15.8 ± 0.8

Radium-226 by gamma spectroscopy of the 186 kev line corrected for uranium-235 contribution.

Sample	Results - Bq/g
UTS-1	3.49
UTS-2	5.64
UTS-3	14.6
UTS-4	35.9
UTS-5	17.75

...2

Radium-226 by gamma spectroscopy of Bi-214 and Pb-214 lines at 295, 351, and 609 kev. Mean of the three values reported.

Sample	Results - Bq/g
UTS-1	3.52
UTS-2	5.0
UTS-3	14.4
UTS-4	35.6
UTS-5	17.5

Thorium-230 by alpha spectroscopy after isolation on cerium hydroxide precipitate.

Sample	Results - Bq/g	Ave. Total Counts	Mean and Std. Deviation (1σ)
UTS-1	3.83, 3.46, 4.04*, 3.64*	(6,700)	3.74 ± 0.22
UTS-2	3.87, 4.08, 3.78, 3.80*, 3.72*	(6,900)	3.85 ± 0.15
UTS-3	11.48, 11.69, 12.56, 11.3*, 11.1*	(21,000)	11.63 ± 0.56
UTS-4	16.59, 16.5, 18.6*, 20.6*	(32,000)	18.1 ± 1.7
UTS-5	15.65, 15.63, 15.91, 15.82, 15.32, 15.8*, 15.1*	(28,000)	15.6 ± 0.3

* - these samples were counted twice as long as the others so their average total counts are double those shown.

Lead-210 by beta counting of its bismuth-210 daughter after isolation by solvent extraction.

Sample	Results - Bq/g	Ave. Total Counts	Mean and Std. Deviation (1σ)
UTS-1	3.33, 3.33, 3.51, 3.63, 3.66, 3.66	(8,000)	3.52 ± 0.16
UTS-2	5.07, 5.55, 5.66, 5.11, 5.44, 5.40, 5.55, 5.36, 5.55, 5.48	(13,000)	5.42 ± 0.19
UTS-3	15.35, 15.91, 15.91, 16.28, 16.27, 15.91, 16.65, 15.35, 16.35	(39,000)	16.00 ± 0.44
UTS-4	38.84, 39.77, 39.59, 38.48, 38.85, 42.55, 41.81	(97,000)	40.0 ± 1.6
UTS-5	16.83, 16.65, 16.65, 17.02, 17.20, 17.39, 17.68	(42,000)	17.06 ± 0.39

...3

Polonium-210 by self-deposition on silver disks.

Sample	Results - Bq/g	Ave. Total Counts	Mean and Std. Deviation (1σ)
UTS-1	2.92, 2.92, 2.89, 2.81, 2.81, 2.89, 2.96, 2.81	(5,000)	2.88 ± 0.06
UTS-2	3.88, 4.25, 3.88, 3.88, 4.37, 4.07, 4.44, 4.37, 4.00	(7,400)	4.13 ± 0.23
UTS-3	11.84, 11.84, 11.84, 11.65, 12.02, 11.84, 12.21, 12.21, 11.47	(21,000)	11.88 ± 0.24
UTS-4	29.60, 30.34, 28.86, 28.12, 31.08, 27.75, 29.60, 29.60	(52,000)	29.4 ± 1.1
UTS-5	11.47, 12.58, 12.95, 12.58, 11.84, 11.84, 12.95	(22,000)	12.32 ± 0.60

Thorium-232 by alpha spectroscopy after precipitation on cerium hydroxide.

Sample	Results - Bq/g	Ave. Total Counts	Mean and Std. Deviation (1σ)
UTS-1	0.66*, 0.55*, 0.65, 0.65	(1,100)	0.63 ± 0.05
UTS-2	0.56*, 0.68*, 0.85, 0.84, 0.77	(1,300)	0.74 ± 0.11
UTS-5	1.69*, 1.72*, 1.93, 1.71	(3,100)	1.76 ± 0.10

* - these samples were counted twice as long as the others so their average total counts are double those shown.

Thorium-232 by neutron activation analysis.

Sample	Results - Bq/g
UTS-1	0.61
UTS-2	0.74
UTS-3	1.76
UTS-4	0.03
UTS-5	0.04

Thorium-228 by alpha spectroscopy after precipitation on cerium hydroxide.

Sample	Results - Bq/g	Ave. Total Counts	Mean and Std. Deviation (1σ)
UTS-1	0.65*, 0.58*, 0.65, 0.65	(1,100)	0.63 ± 0.03
UTS-2	0.56*, 0.68*, 0.87, 0.79, 0.74	(1,300)	0.73 ± 0.11
UTS-5	1.69*, 1.72*, 2.02, 1.98	(3,300)	1.85 ± 0.15

* - these samples were counted twice as long as the others so their average total counts are double those shown.

...4

Radium-228 by the beta counting of its daughter actinium-228 after isolation by solvent extraction.

Sample	Results - Bq/g	Ave. Total Counts	Mean and Std. Deviation (1σ)
UTS-1	0.54, 0.53, 0.55, 0.52, 0.57	(1,300)	0.54 ± 0.02
UTS-2	0.91, 0.80, 0.89, 0.80, 0.80, 0.85	(2,000)	0.84 ± 0.05
UTS-5	1.70, 1.59, 1.66, 1.59, 1.66, 1.88, 1.59	(4,000)	1.67 ± 0.10

In all the above determinations a 1 g sample aliquot was used except for the gamma spectroscopy (10 g). All samples were dissolved with a pyrosulfate fusion after eliminating silica with $HF-H_2SO_4$. The melt was dissolved in nitric acid for the radium determinations and in HCl for Pb-210, Po-210 and thorium determinations. Radium-226 was determined by our conventional lead sulfate-barium sulfate separation followed by gross alpha counting of the final barium sulfate procedure. The procedures for radium-228, lead-210 and polonium-210 are those given in CANMET Report 78-22. Thorium isotopes were isolated by a series of iron hydroxide, barium sulfate precipitations followed by extraction with TTA (see CANMET 78-22) and finally by precipitation with cerous hydroxide filtered on tuffyryn HT-100 paper. The cerous hydroxide precipitate was then analyzed by alpha spectroscopy using a surface barrier detector.

Barium-133 was used as a tracer in the radium-226 procedure and thorium-234 as the tracer in the thorium isotope measurement. The calibration standard for radium-226 was NBS 4953-C. Aged thorium nitrate from Amersham was the standard for thorium isotopes and radium-228. For both lead-210 and polonium-210 the Amersham standard RBZ-44 (#S8/40/27) was used. It has an overall calibration uncertainty of ± 2.3%.

Calibrations for Ra-226 covered the range 0.004 Bq to 33 Bq. For Ra-228, Pb-210 and Po-210 the range was 0.004 Bq to 20 Bq. For thorium isotopes the calibration range was 0.004 to 0.5 Bq. The mean response for multiple standards was used in determining the calibration factor.

Sample analyses and calibrations were performed by Verda Penner, Marion Knelson, Reinhold Ortlepp and Lloyd MacDonald.

A couple of the results are a bit uncertain (i.e. Ra-226 for UTS-4 and Th-230 for UTS-4) and we will endeavor to check these values in the coming weeks.

The agreement between gamma spectroscopy and radium-226 radiochemical measurements are quite good in most cases except for UTS-3 and UTS-4. We have been unable to determine the reason for this discrepancy.

Yours truly,

R. Gene

Dr. Gene Smithson
Head, Analytical Services Section

GS/ldd

DISCLOSURE CERTIFICATION

Contract File Number: 15SQ.23440-2-9145-1

Contract Serial Number: OSQ82-00182

We certify that there are no disclosures to submit under the above referenced contract, referred to in Section 4 of DSS 1036.

Signature: ..Gene Smithson

Dr. Gene Smithson

Principal Research Scientist

Official Title